

REMARKS

A. STATUS OF THE APPLICATION

- i. Disposition of Claims
 - a. Claims 1-26 are pending in the application.
 - b. Claims 1-26 have been rejected under 35 U.S.C. § 103(a).
 - c. The disclosure has been objected to based upon informalities.
- ii. Applicants' Action
 - a. Claims 1, 8, and 22 have been amended to overcome the rejection of Claims 1-26.
 - b. Claim 7 has been canceled.
 - c. Applicants respond to the rejection of Claims 1-26.
 - d. The Specification has been amended to overcome the informalities.
 - e. Replacement Sheet of Figure 2 is also submitted to overcome the informalities.

B. THE PRESENT INVENTION

The present invention is directed to a lithium-ion high power battery in a bipolar configuration wherein one of the main technical features of the present invention is that the anode-to-cathode capacity ratio in the bipolar battery configuration is between 0.6 to 1. In the present invention, the anode-to-cathode ratio being less than 1 is significant in that prior art lithium-ion systems taught that an anode-to-cathode ratio should be greater than 1 to improve battery safety and battery cycle life. Accordingly, this unexpected discovery in the present invention—the anode-to-cathode ratio between 0.6 and 1—when applied to the specific battery system and configuration of the present invention, can minimize the electronic monitoring for safety, while simultaneously enjoying the full advantages of higher battery cycle life.

C. RESPONSE TO REJECTION UNDER 35 U.S.C. § 103(A)

Claims 1-19 and 22-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fauteux *et al.* (US 2003/0194605), in view of either Ubukawa *et al.* (JP 5-62,712) or Tsushima *et al.* (US 6,294,292) and in view of Itoh *et al.* (US 2002/0051904). Applicants respectfully disagree with the Examiner's reasoning of obviousness under 35 U.S.C. § 103(a) with reference to Fauteux *et al.* in view of either Ubukawa *et al.* or Tsushima *et al.*

Initially, the Examiner's reading and application of Fauteux *et al.*, Ubukawa *et al.*, Tsushima *et al.*, and Itoh *et al.* are set forth in the Office Action and will not be repeated here except as necessary to an understanding of Applicants' traversal, which will be described below.

The Examiner admits that the present invention differs from the Fauteux *et al.* reference in that the present invention recites that the number of cells in a group ranges from 2 to 10, means for monitoring the voltage of a subgroup of cells, which is less than the number in the group, and a ratio of anode-to-cathode capacity is between 0.6 and 1.3.

By this response, Applicants have canceled Claim 7 and its limitations are now incorporated in Claim 1. Accordingly, the anode-to-cathode ratio as claimed in the present invention is now between 0.6 to 1.0.

Contrary to the Examiner's position, the combination of the Fauteux *et al.* and Tsushima *et al.* references is inappropriate because the references are not combinable to reject the claims as presently amended for the following reasons. The Tsushima *et al.* reference teaches an electric double layer capacitor having a cathode-to-anode ratio of 0.1 to 1.2. *i.e.*, the anode-to-cathode ratio would be 0.83 to 10. An electric double layer capacitor is a very different type of electrochemical system from a battery. As such, one of ordinary skill in the art would not have relied upon that reference to determine an optimal ratio of anode to cathode capacity in a lithium-ion battery with a bipolar configuration. Being an electric double layer capacitor, the positive electrode of Tsushima *et al.* consists of activated carbon, and may only optionally contain a small amount (0.1 to 20 wt%) of a lithium metal oxide. The inclusion of the lithium metal oxide in the Tsushima *et al.* reference is for a mere purpose of providing a reserve source of lithium ions in the event that the electrolyte becomes depleted in the electric double layer capacitor. In other words, in the electric double layer capacitor, the anode-to-cathode capacity is dependent upon the carbon, and not the lithium metal oxide. In a bipolar configuration of a lithium-ion battery in the present invention, however, 100% of the anode-to-cathode capacity ratio is due to a lithium metal oxide. For such lithium-ion systems, prior art references teach that the cathode-to-anode capacity ratio should be less than one, *i.e.*, the anode-to cathode ratio should be greater than 1.

With respect to the Ubukawa *et al.* reference, the ratio of cathode to anode capacity is between 1:1 to 1:1.3. According to the Examiner, this ratio translates to an anode-to-cathode

capacity ratio having 0.77 to 1. This is inaccurate. Rather, this translates to an anode-to-cathode ratio of 1 to 1.3. In other words, the Ubukawa *et al.* reference teaches the accepted prior art position that the anode-to-cathode capacity ratio of conventional lithium-ion batteries should be greater than 1, *i.e.*, the battery capacity is limited by the cathode for safety reasons. If the Ubukawa *et al.* reference had considered, or the prior art references have considered, the anode-to-cathode ratio being less than 1, certainly the Ubukawa *et al.* reference would have suggested that fact. The fact that the Ubukawa *et al.* reference neither discloses nor suggests such ratio to improve battery safety, cycle life, and excellent power, performance indicates that the present invention is inventive. Accordingly, this surprising result could not have been predicted by one of ordinary skill in the art based upon the disclosures of the Tsushima *et al.*, Fateaux *et al.*, or Ubukawa *et al.* references.

Since the combination of the Fateaux *et al.* reference with either Tsushima *et al.*, which relates to an electric double layer capacitor and not a battery, or Ubukawa *et al.*, which has the anode-to-cathode ratio greater than 1, is essential to the rejection, and because such combination is inappropriate, Applicants respectfully request withdrawal of the rejection.

D. RESPONSE TO THE INFORMALITIES

The disclosure is objected to because numeral 32, without prime (') or double prime (''), in figure 2, is not found in the specification. The numeral 81, found in the specification on page 8, lines 37, is not found in the drawings. In response, the changes are made in Figure 2 so that now replaced Figure 2 shows numeral 32 with double prime ('') and the contacting means of numeral 81 is also shown. See page 11 of this paper. No new matter has been added from the changes.

The Trademarks "SURLYN" and "ACLAR" have been accompanied by their generic terms to overcome the objection by the Examiner.

E. CONCLUSION

Based on the above, Applicants submit that Claim 1 is not disclosed, taught, or suggested by the cited references. As such, Claim 1 along with its respective dependent claims 2-6, 8-26, are considered to be in condition for allowance and Applicants respectfully request the rejections to the claims be withdrawn. In order to expedite disposition of this case, the Examiner is invited to contact Applicants' representative at the telephone number below to resolve any remaining issues.

Respectfully submitted,

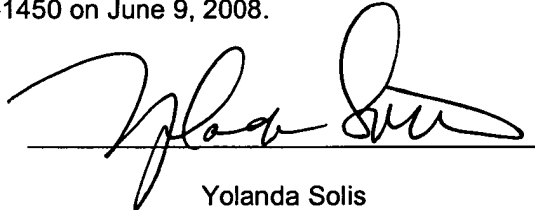


Nick S. Lee, Reg. No. 54,260
One of Applicants' Attorney

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Yolanda Solis